of the experimental sciences, and as there are no public laboratories available for the researches of private investigators, it may be said that in many branches of experimental science the State affords no permanent material aid to such investigators."

Assistance of a permanent description is also afforded to learned societies, by providing them with apartments free of rent, or with annual grants of money in lieu of such accommodation: the sum of 500*l.* granted annually to the Royal Geographical Society under certain conditions is an instance of such a grant.

We may regard as a permanent aid to science the grant of 1,000*l.* for researches carried on by private individuals, which is annually voted by Parliament, and administered by a Committee of the Royal Society.

The first proposal for such a grant was contained in a letter (dated October 24th, 1849) from Earl Russell then (Lord John Russell) to the then President of the Royal Society (the Earl of Rosse), and was to the following effect:—

> "As there are from time to time scientific discoveries and researches which cost money and assistance the students of science can often but ill afford, I am induced to consult your lordship, as President of the Royal Society, on the following suggestion:—
>
> "I propose that at the close of the year the President and Council should point out to the First Lord of the Treasury a limited number of persons to whom the grant of a reward, or of a sum to defray the cost of experiments, might be of essential service. The whole sum which I could recommend the Crown to grant in the present year is 1,000*l.*, nor can I be certain that my successor would follow the same course; but I should wish to learn whether, in your lordship's opinion and that of your colleagues, the cause of science would be promoted by such grants."

Lord Rosse, in reply to the proposal made by Lord J. Russell, expressed his personal opinion that the judicious employment of grants in the way proposed "would very materially promote the advancement of science;" and of the two alternatives, namely, expending the 1,000*l.* in rewards, or appropriating it to the payment of the expenses of experiments, he preferred the latter, indicating his reasons as follows:—

> "There are often details to be worked out before it is possible to employ usefully newly discovered principles. In many of the sciences reductions are required before observations can be made use of. Both in science and art, facts technically called constants are the materials of discovery; to determine them accurately is of great importance. Now in all these cases, and in many others, the work to be done is laborious and expensive, and as it adds but little comparatively to the fame of the individual, it especially requires encouragement."

With regard to this "Government grant" Sir Edward Sabine in his evidence says: . . . "I suppose that the 1,000*l.* in one year was designed as an experiment to try the matter in the first instance. I always understood that Lord Russell contemplated that the sum would be augmented if the plan were found to work well."

No change however has been made either in the amount of the grant or in its mode of distribution since its first establishment.

As examples of the second—occasional—kind of aid, expeditions for special researches, outfits of ships, and apparatus and grants of money for such researches, are mentioned. Great as is the value of these contributions, the Commissioners pointedly remark that "they do not appear to be granted or refused on any sufficiently well-defined principle."

The lesson, indeed, which crops up throughout the invaluable investigations of this Commission, is that there is a total want of system in almost all that we do, as a nation, towards advancing scientific research.

(*To be continued.*)

THE ENCYCLOPÆDIA BRITANNICA

The Encyclopædia Britannica; a Dictionary of Arts, Sciences, and General Literature. Ninth Edition. Vol. II., ANA to ATH. (Edinburgh: Adam and Charles Black, 1875.)

IN reviewing the first volume of this new edition of the "Encyclopædia" (NATURE, vol. xi. p. 343), we were obliged, by want of space, to omit more than the briefest possible remarks upon the general plan of the work. The conspicuous and increasing success of the work is apparently a sufficient answer to those who would find fault with the form of arrangement peculiar to this "Encyclopædia." Among the considerable number of Cyclopædias which have been produced in Great Britain during the last hundred years, this one, almost alone, has been reproduced in a number of successive editions, growing in excellence and reputation, and many people might take this fact to be a sufficient proof that it is well designed to meet a general want. But this success must surely be due in great degree to the eminence of the contributors, to the skill of the editors, or to any circumstance rather than the scheme of the work.

We have always been unable to comprehend the exact *raison d'être* of a cyclopædia which is neither strictly alphabetical nor strictly systematic. The "Britannica" may be compared to a solid body of pudding with plums in the form of excellent treatises disposed here and there. Now we entirely fail to perceive any convenience in this mode of construction. That it is not very suitable for the purpose of simple reference seems to be proved by the need of a full index to the whole of the volumes. Nor, if a person wishes to use one of the articles for careful continuous study in the manner of a text-book, is it convenient to have it embedded in a very heavy quarto volume, one of a large and costly series. Many valuable and highly useful treatises are in fact buried in this "Encyclopædia," and are hardly available for purposes of general reading. That this is so has been confessed by the separate publication of some of the principal treatises in former editions; those, for instance, by Sir John Herschel on "Physical Geography," and on "Meteorology."

Cyclopædias have varied in form from the purely alphabetical ones, best represented now in "Chambers' Cyclopædia," which approximates to the character of a dictionary, to "Lardner's Cyclopædia," in which each subject was treated in a distinct and handy volume. Coleridge tried to combine the two principles in the "Encyclopædia Metropolitana," in which all sciences and branches of knowledge were to be expounded in a series of elaborate treatises, arranged according to logical method, while an alphabetical dictionary of reference was added as a complement. The treatises contributed to this work by Herschel, Airy, De Morgan, Peacock, Whately, Senior, and others, are some of the most profound works in English scientific literature, and maintain their scientific value after the lapse of forty years or more. It was the weight of these too-valuable treatises which damned the commercial success of the whole scheme.

The "Encyclopædia Britannica" has effected a compromise between the systematic and alphabetic methods in another way, altogether inferior in a logical point of view, but far more successful as actually carried into effect. In this volume we have forty-four important articles, almost every one of which is written by a master of the subject, if not in every case by its most eminent representative. The longest of these except one is that on *Astronomy*, by Mr. R. A. Proctor. It occupies eighty quarto pages, in addition to four large plates of engravings, and might be easily made to fill a good-sized octavo volume of 400 or 500 pages. This article is on the whole a satisfactory compendium of the science, but it is matter of regret that Mr. Proctor cannot avoid exhibitions of bad taste. He has no right to insinuate in the second column of p. 786 that two of the joint authors of an important scientific paper are the *assistants* of the one first named. The accuracy of some of Mr. Proctor's statements as to the history of recent discoveries in solar astronomy would have to be seriously called in question, were it possible in an article of this kind to enter upon a subject involving many details.

One of the most profound and at the same time interesting articles is that of Dr. E. B. Tylor on *Anthropology*, occupying about sixteen pages. As we should expect from the principal founder of the new science, it contains a luminous abstract of the evidence concerning the antiquity, descent, and development of the human race, mainly brought to notice since the last edition of the "Encyclopædia" was published. Taken in connection with Prof. Daniel Wilson's article on *Prehistoric Archæology*, and Prof. St. George Mivart's elaborate account of the *Ape Family*, filling twenty-one pages, we have in this single volume of the work a full supply of information relating to the origin and affinities of the human species. It is curious to compare the views discussed in these articles with those propounded in earlier editions of the "Encyclopædia" under the title "Creation."

Probably the longest article in the volume is that, the joint production of Prof. T. Hayter Lewis and Mr. G. E. Street, upon *Architecture*, which, taken together with a very useful glossary of architectural terms, extends over ninety-four pages. If reprinted in a separate volume it would form a convenient and much-needed text-book of the science. As treated by Mr. Ferguson, the history of architecture forms in fact one of the most instructive branches of the new science of Sociology, and no subject of study is better calculated to produce correct views of the origin and development of civilisation. We are unable to understand why the work of Mr. Ferguson is referred to in the Bibliography of the subject (p. 457) only under the head of Chinese Architecture.

It will be a matter of regret to many that Professor Huxley's article on the *Classification of the Animal Kingdom* is restricted to six pages, but it is surprising how many profound remarks he has managed to compress into this narrow compass. The article, however, is only suited for the reading of experts. The article, again, on the word *Aryan*, by Prof. Max. Müller, is another one of which the brevity must be lamented, unless it be supplemented by other articles on closely allied topics, to which there is no reference.

In spite of the fulness and excellent quality of some of the articles relating to physical or natural science, we entertain some fear that the weakest side of the "Encyclopædia" will lie in this direction. The method of arrangement prevents us from speaking with confidence, because it is impossible to say how far subjects which are weakly treated or altogether omitted in their alphabetical place, will be introduced into later systematic articles. There are indications, however, that Prof. Spencer Baynes is not as ably supported in chemical, mathematical, or general physical subjects as he should be. The brief account of *Antimony*, for instance, is a very perfunctory production, and, if the other elements are to be treated in like manner, we should prefer to find them omitted altogether. If Mr. Baynes can spare barely more than one column for an element of considerable importance, he need not have told us that the paint said in the Holy Scriptures to have been used by Jezebel was made of stibnite containing antimony. Nor need a sentence have been wasted in repeating a tradition to the effect that the metal was called antimony because a preparation of it proved fatal to monks (hence *antimonachos*), a tradition, it is added, which will hardly bear investigation. If so, why give the tradition when there is so much else of importance omitted.

The article on *Assaying*, though not positively bad, is not up to the proper mark, and is not sufficiently precise to be of any technical value. The subject should either have been omitted or more developed, and placed in the hands of Mr. Chandler Roberts, the chemist and assayer of the Royal Mint, who would have been in every way the most fit writer to treat it.

We hope that the column given to *Anthracite* is not a specimen of the way in which so important a subject as Coal is to be dismissed. Yet it contains no reference to Coal, Fuel, or other articles on related topics. Moreover, we are unable to comprehend why, if there is to be a satisfactory systematic article on Coal, as surely there must be, this brief separate account of anthracite should be given. As the article remarks, "No sharply defined line of demarcation can be drawn between anthracite and the bituminous varieties of coal, as the one series merges by imperceptible degrees into the other." If so, why allow the mere name to give rise to a separate article, when the alphabetic system is not observed in other cases?

Every now and then the mixture of systems gives rise to a waste of space by useless repetitions. Thus, under *Asteroids*, we find an article of seventeen lines, ending with a reference to p. 806 in the article on *Astronomy*. Turning to this page, we find a pretty full account of the asteroids, filling four columns, and containing a complete and useful table or the whole of the minor planets, which were 143 in number when the table was drawn up, although two or three new additions have since been made. It is obvious that a mere reference under the name *Asteroid* would have been sufficient. The editor avoids the introduction of the copious references which are to be found in the "Penny Cyclopædia," "Rees' Cyclopædia," and many other ones, but he does not do this consistently and completely. In other cases subjects of considerable importance are treated with the brevity of a dictionary, and yet no references are added. Take, for instance, the account of the word *Anodyne* given in seven lines, and containing merely the meaning and etymology of the name, and a list of six substances used as anodynes. There is no reference to anæsthetics or any other article where the subject might be fully studied.

Perhaps the worst article allowed to stand in this volume is that under the word *Angle*, which tells us in twenty-seven lines, and by aid of a figure, what an angle is, what a right angle is, how the whole circumference is divided into 360°, and so on, concluding by a reference to geometry and trigonometry. Such a puerile description of the word would not be tolerated in "Chambers' Information for the People" or Cassell's Popular Educational works. There is only a single sentence in this article which could in all probability give new information to any person likely to consult such a work as the "Encyclopædia Britannica."

It is not our duty, of course, to form any judgment upon the larger part of this volume, which treats of literary or artistic subjects. The many articles treating of classical, biographical, geographical, and other information are probably on the whole superior to the parts devoted to physical and mathematical science. The scarcest and perhaps the weakest articles altogether are those on mathematical topics. There are, indeed, in this volume only two articles of any length which can be called mathematical. That on *Annuities* is a fair one, especially as supplemented by other articles to which reference is made. That upon *Arithmetic*, however, is a very dry, perfunctory production, chiefly consisting of a mere compendium of the ordinary rules. We do not recognise the name of the author by his initials, and the name is not made public in the list of principal contributors. It is obvious that the "Encyclopædia Britannica" will not compare in the mathematical department with the "Penny" or the "English" Cyclopædias, which contain a splendid series of articles by De Morgan of permanent interest and value. While, therefore, we can entertain no doubt that, taken as a whole, the "Encyclopædia Britannica," as now republishing, is excellently edited, we think that Prof. Baynes is inclined to sacrifice in some degree the less for the more popular branches of knowledge.

We are driven to this conclusion when we compare the number and length of the articles given to the more severe scientific subjects with those upon more popular topics, such as *Architecture* and *Archæology*. The treatise on *Army*, again, taken in connection with that upon *Arms and Armour*, takes up a very large amount of space. No doubt it is requisite that War, which occupies unfortunately so large a part of the attention of Europe at the present time, should be fairly noticed in an "Encyclopædia" intended for the use of all. It is a matter of opinion and a question of degree and of proportion in which it is hopeless for Prof. Baynes to please all parties. But it may be well to remind Prof. Baynes that the more popular articles are those which will soon lose their value. Such an article as that on *Army* rapidly becomes antiquated by the progress of political and social changes and of mechanical invention, whereas good mathematical essays like those of De Morgan or Peacock retain their value for hundreds of years. Almost the only volume of "Lardner's Cyclopædia" now sought after is that by De Morgan on the Doctrine of Probabilities.

Although the "Encyclopædia Britannica" seems a very costly work to purchase, it must really be considered, in proportion to its contents, very cheap. We find that this second volume contains at least 1,100,000 words, in addition to thirty large and expensive engraved plates. Now, the same quantity of matter purchased in the form of detached treatises would probably cost from two to four times as much. It is true that when we select our own library we generally purchase works which we intend to read more or less completely, whereas the persons who would read an encyclopædia through would be truly exceptional characters, though we have heard it reported that such persons do exist. A cyclopædia is published on the principle which auctioneers seem to adopt in selling books, of mixing up what a purchaser does not want with what he does want; so that he has to buy all the more. Those, however who do want a library selected for them cannot do better than confide in the work of Prof. Baynes and his predecessors.

OUR BOOK SHELF

Annual Record of Science and Industry for 1874. Edited by S. F. Baird. (New York: Harper and Brothers, 1875.)

The Year-book of Facts in Science and the Arts for 1874. Edited by C. W. Vincent, Assistant in the Library of the Royal Institution of Great Britain. (London: Ward, Lock, and Tyler, 1875.)

THE American "Annual Record of Science," is a work that each year grows in interest and value. It now consists of two distinctive parts (1), an historical summary of the progress of various branches of science and industry during the past year; and (2), classified groups of paragraphs, giving a succinct report of noteworthy occurrences or special scientific investigations. At the end of the volume is a catalogue of scientific books published during the year, and also a capital index to the whole work. The summary of progress has grown from sixteen pages in 1871, when this Annual first appeared, to 200 pages in the present volume. Each department of science is separately treated, and in the preparation of the different parts the editor has had the co-operation of numerous eminent men of science. Evidently no pains have been spared to make the Record as complete as possible, and so far as we are competent to judge, it is as accurate as it is comprehensive.

In his modest preface to the volume, the editor tells us he has been urged by some to make the abstract of papers more detailed; we think, however, Mr. Baird has exercised a wise discretion in his present arrangement, and at the same time we are glad to learn that he intends publishing a series of annual reports on special branches of science similar to what already exists, to some extent, in Germany. In England we have nothing corresponding either to the general record of science or to the special reports, and the want of such works is increasingly felt. We hope that before long some one of our leading publishers will see their way to issuing a really good digest of the annual progress of natural knowledge in all its various branches.